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**Bed-sharing by breastfeeding mothers: who bed-shares,
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Keywords:	breast feeding duration, bed sharing, co-sleeping, SIDS, breastfeeding intent

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Bed-sharing by breastfeeding mothers: who bed-shares and what is the relationship with breastfeeding duration?

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Running Title: bed-sharing and breastfeeding outcomes

Abstract

Aim: To explore the link between breastfeeding duration and bed-sharing frequency among women reporting a prenatal intention to breastfeed.

Methods: 870 participants in a randomised breastfeeding trial, recruited at mid-pregnancy, provided weekly snapshots of breastfeeding and bed-sharing behaviour for 26 weeks following birth. Strength of prenatal breastfeeding intent was recorded at recruitment using Likert-type scales.

Results: Outcomes were frequency of bed-sharing at home for at least one hour per week, and time to cessation of breastfeeding. There were insufficient data to classify bed-sharing pattern in 192/870 (22%) of mothers. Of the remainder, 44% (299/678) of participants 'rarely' or 'never' bed-shared, 28% (192/678) did so 'intermittently' and 28% (187/678) did so 'often'. These three groups did not differ significantly in marital status, income, infant gestational age, maternal age or delivery mode. Significantly more participants who bed-shared 'often' reported strong prenatal breastfeeding intent (70% vs. 57% and 56% for 'intermittent' and 'rare' bed-share groups), and attached high prenatal importance to breastfeeding (95% vs 87% and 82%). Significantly more women who bed-shared frequently were breastfeeding at 6 months ($p < 0.0001$) than those who intermittently or rarely/never bed-shared.

Conclusions: Women with strong motivation to breastfeed frequently bed-share. Given the complex relationship between bed-sharing and sudden infant death syndrome (SIDS) appropriate guidance balancing risk minimisation with support for breastfeeding mothers is crucial.

Keywords: breastfeeding, bed-sharing, co-sleeping, SIDS, breastfeeding intent.

Key Notes

- Infant sleep location is associated with breastfeeding duration; mothers who bed-share consistently breastfeed for longer than mothers who do not bed-share.
- Frequent bed-sharers differed from intermittent and rare/never bed-sharers only in the strength of their prenatal breastfeeding intent, the importance they attached to breastfeeding, and subsequent duration of any and exclusive breastfeeding.
- Singular messages to avoid bed-sharing are unhelpful; risk minimisation approaches are needed for these mothers.

Abbreviations used

NECOT	North-East Cot Trial
SIDS	Sudden Infant Death Syndrome
SUDI	Sudden Unexpected Death in Infancy
UK	United Kingdom
US	United States

Breastfeeding is important for immediate infant and maternal wellbeing and for lifetime health. It is well documented that the use of breastmilk substitutes is associated with poorer outcomes for both infants and mothers (1, 2). Breastfeeding is therefore widely recommended by international health agencies (e.g. 3), with the World Health Organisation recommending exclusive breastfeeding for the first six months of life, continued thereafter for at least 2 years with the addition of appropriate complementary foods (4). Numerous studies have examined the factors influencing initiation and continuation of breastfeeding (e.g. 5-7) and how to use this knowledge to best support mothers in achieving their breastfeeding goals (e.g. 8).

Infant sleep location is one factor affecting breastfeeding in western societies that is still poorly understood. The strong positive association between breastfeeding and maternal-infant bed-sharing (9-10), which stands in stark contrast to guidance in several countries explicitly advising parents to avoid bed-sharing (e.g. 11, 12), means this is a topic where further research is vital. To date the relationship between breastfeeding and mother-infant bed-sharing has been explored in several ways: the direct effect of bed-sharing on breastfeeding behaviour and physiology has been examined in laboratory, hospital and domestic settings (e.g. 13-15); the correlation between bed-sharing practice and breastfeeding outcomes has been statistically demonstrated in large epidemiological studies (16-19); and the importance of the experiential relationship between bed-sharing and breastfeeding has been described by mothers in qualitative studies (9, 10, , 20).

The evidence that parent-infant sleep sharing is associated with sudden and unexpected deaths in infancy (SUDI) in certain hazardous contexts is strong. These deaths may be designated as accidental (e.g. wedging, overlaying, suffocation) or unexplained, with the latter fulfilling the designation for SIDS (Sudden Infant Death Syndrome) as "the sudden unexpected death of an infant <1 year of age, with onset of the fatal episode apparently occurring during sleep, that remains unexplained after a thorough investigation" (21). Multiple studies have found an association between SIDS and infants sleeping with adults on surfaces other than a bed, bed-sharing with parents who smoke or who have taken drugs, medications or alcohol, and bed-sharing with a preterm or low birth weight infant (22). In the absence of these hazards, however, the most recent evidence reveals no increased risk, at least in the UK (23).

Parent-infant bed-sharing is neither uniformly risky nor safe for infants; it is therefore important to anticipate which mothers are most likely to bed-share, to understand how risk

might vary for each group, and to tailor appropriate guidance that balances risk
minimisation with support for breastfeeding mothers. More than a decade ago Blair & Ball
(24) reported that 50% of English parents, the majority of them breastfeeding mothers,
found themselves bed-sharing with their baby regardless of their prenatal beliefs that they
would not do so (25). At that time breastfeeding initiation rates in England & Wales were
comparatively low (68%); recent increases in breastfeeding initiation in England (to 83%)
means that even more babies will experience bed-sharing. This paper therefore examines
enrolment and follow-up data from a previously published large randomised trial of
breastfeeding and infant sleep location in a UK hospital post-natal ward to consider the
sleep arrangements of breastfeeding mothers and infants, to identify which breastfeeding
mothers bed-share, and to explore how bed-sharing relates to breastfeeding outcomes.

Participants and Methods

We used data from 870 mothers who participated in a randomised controlled trial between 2008 and 2010 that was designed to detect whether different bassinet types used in the postnatal ward of a large tertiary hospital in North East England affected breastfeeding duration. We previously reported that the trial intervention (provision of a side-car bassinet on the postnatal ward as opposed to the usual free-standing bassinet) was not associated with a significant difference in breastfeeding duration or frequency of bed-sharing once at home (26). As no differences in behaviour were detected between the two trial arms we were able to combine the follow-up data from all trial participants to examine breastfeeding and at-home bed-sharing in this sample. The study design and primary outcomes have been described in detail elsewhere (26), but briefly, the participants were recruited at their 20 week gestation antenatal scan if they met the following criteria: fluent enough English to understand the nature of the trial; pregnant with a normal single infant; and open to the possibility of breastfeeding. The latter criterion was assessed using a Likert-type scale in which potential recruits were asked to rate their intention to breastfeed. Those who indicated that they had 'no intention to breastfeed' were not recruited; all others were provided with information and asked to consider participation. Women were also asked for baseline demographic information, including whether they had previously breastfed, at the time of enrolment.

Women who miscarried, delivered at <37 weeks gestation, or had infants that were transferred to the Neonatal Unit were excluded from the trial. Following discharge, feeding and sleeping practices were reported weekly for 26 weeks using an automated telephone system with reminder postcards sent via mail. Participants responded to questions by using their telephone keypad and responses were captured via an interactive database (described in 27). If participants failed to respond, they were contacted by telephone, letter or email to obtain follow-up data.

Breastfeeding variables

Prenatal feeding intentions were assessed by asking women to indicate the strength of their breastfeeding intent, and how important they considered breastfeeding to be, on Likert-type scales during enrolment (Figure 1). Note that, categories 1 and 2 for the importance of breastfeeding scale have been combined, since very few women choose either category: this is labelled as 'Unimportant' in the results below. Breastfeeding

outcome variables were based on weekly responses to the automated telephone system. Participants were asked:

In the last week has your baby been:

- a) breastfed or received expressed breast milk (Yes/No);
- b) formula fed (Yes/No);
- c) fed other liquids not including medicines or water (Yes/No);
- d) fed solid foods (Yes/No).

The outcome measures analysed here are a) time to cessation of any breastfeeding (baby no longer receiving human milk) and b) time to cessation of exclusive breastfeeding (baby receiving breastmilk plus other substances).

[FIGURE 1 HERE]

Bed-sharing

Participants responded to three questions about sleep on a weekly basis:

- a) in the last week did your baby sleep in your bed while you were asleep (Yes/No);
- b) if so, was this for at least an hour (Yes/No);
- c) if so, did this occur on more than one night in that week (Yes/No).

Responses to the latter question were discarded due to missing data (>50%). We therefore focused on whether the mother-infant dyad bed-shared for at least an hour each week.

The above definition allowed us to separate mothers and babies who slept together for extended periods from those cases where babies fell asleep in their mother’s arms, or while feeding, and were returned to their own sleeping space within a short period of time. The latter were not categorised here as ‘bed-sharers’. The choice of one hour as the cut-off was arbitrary, representing a standard unit of time that participants were familiar with and which has been used in other studies.

Characterising bed-sharing and bed-sharers

For each participant bed-sharing behaviour was categorised in four-week blocks, beginning from the infant’s birth week; data from weeks 25 and 26 were omitted so that intervals were uniform in length. Each four-week period was characterised by the majority behaviour, as long as data for no more than one week was missing. In each block, a dyad was designated as ‘no bed-share-0’ if the mother did not report sleeping with her baby for at least an hour in at least one of the four weeks in the block, ‘occasional bed-share-1’ if she reported sleeping with her baby for at least an hour in one week only, ‘moderate bed-

share-2' if she reported sleeping with her baby for at least an hour a week in any two weeks in a block and 'frequent bed-share -3' if a dyad slept together for at least an hour in three or four of the 4 weeks in a block, or 'Missing data-9'. These were coded and the codes used to create an ordered sequence representing each dyad across the six 4-week blocks. For illustration, the sequence 011399 denotes a dyad with no bed-sharing in weeks 1-4, occasional bed-sharing in weeks 5-12, frequent bed-sharing in weeks 13-16, and missing data for weeks 17-24. These sequences were used to identify subgroups of dyads with similar bed-sharing patterns across the 24-week period based on the consistency of their bed-sharing behaviour.

Visual inspection was used to sort the coded sequences into groups, and the grouping criteria were documented. Cluster analysis was also performed, but failed to improve on the groups created by systematic coding and visual inspection. Four groups of sequences emerged: dyads that bed-shared a) never or occasionally, b) intermittently, c) often and d) those that provided insufficient data (see Table 1). Responders (groups a-c) were compared with non-responders (group d) to ascertain whether there were any differences in demographic factors (see Table 3).

[TABLE 1 HERE]

The socio-economic and birth circumstances of mothers were summarised in the form of percentages for categorical variables and mean and standard deviation for continuous variables: this was done for the whole cohort, and by bed-share group. Chi-squared and analysis of variance tests were used to detect whether there were any statistically significant differences between these groups in the distribution of explanatory variables: the comparisons were between the three subgroups with near complete bed-sharing data, and then between these groups combined and those for whom bed-sharing data were often missing to assess the generalisability of the available results.

The distribution of the length of 'any' and 'exclusive' breastfeeding was compared between bed-sharing subgroups. Breastfeeding data were censored at 26 weeks or time of drop-out from the study (defined as failure to provide data for at least 4 successive weeks). The Kaplan-Meier survivor functions for any and exclusive breastfeeding were generated for each bed-sharing group, illustrated by a graph, and summarised by the median time to stopping breastfeeding. The log-rank test was used to test for a difference in breast-feeding duration across bed-sharing groups.

Results

Table 2 shows the baseline characteristics of the 870 trial participants contributing data on breastfeeding and bed-sharing for these analyses: the socioeconomic make-up is typical of women considering breastfeeding, tending towards older age, more education and higher income. Trial participants providing no data tended to be slightly younger, less likely to be white, and had a lower household income (26).

[TABLE 2 HERE]

Bed-sharing behaviour

There was insufficient data to classify bed-sharing pattern for 192/870 (22%) of mothers. Of the remainder, 44% (299/678) of participants ‘rarely’ or ‘never’ bed-shared, 28% (192/678) were in an ‘intermediate’ group who did so intermittently and 28% (187/678) did so ‘often’ (for at least an hour). When we applied less stringent bed-sharing criteria (bed-sharing of any duration), very few mothers reported never sleeping with their baby at all (15/870, 2%).

Breastfeeding outcomes and infant sleep location

Figure 2a shows the duration of any breastfeeding in the three bed-sharing subgroups. A greater proportion of women continued breastfeeding for longer in those subgroups where bed-sharing was more common: this difference is statistically significant ($P<0.0001$). The median time to cessation of any breastfeeding was 14 weeks for those who rarely bed-shared, 24 weeks for intermediate bed-sharers, and over 26 weeks for those who bed-shared often.

[FIGURE 2a & 2b HERE]

Figure 2b shows the duration of exclusive breastfeeding by bed-sharing subgroup. Only 66% overall initiated exclusive breastfeeding and this dropped sharply over the first few weeks after birth. A greater proportion of women continued exclusive breastfeeding for longer in those subgroups where bed-sharing was more common: this difference was statistically significant ($P<0.0001$). The median time to cessation of exclusive breast feeding was 3 weeks for those who rarely bed-shared, 5 weeks for intermediate bed-sharers, and 10 weeks for those who bed-shared often.

Characteristics associated with bed-sharing patterns

The participant characteristics for each bed-share group are shown in Table 3. The results of the significance tests comparing the three bed-sharing groups with near-complete data (Rarely/Intermediate/Often) are given in the PValue¹ column. There were no significant differences across these three bed-share groups in terms of marital status, household income, infant gestational age, maternal age, or delivery mode. However, significantly more mothers who bed-shared often reported prenatally that they deemed it important to breastfeed their child (70% compared to 57% and 56% respectively for those who bed-shared intermittently, or rarely/never). Furthermore, women expressing strong prenatal intent to breastfeed bed-shared most frequently (i.e. 95% of 'often' bed-sharers, 87% of 'intermittent' vs. 82% of 'rarely' bed-share groups respectively reported they 'would like to' or 'will definitely' breastfeed.). This patterning did not simply reflect prior breastfeeding experience; previous breast-feeders comprised 52% of frequent, 48% of intermittent and 40% of rare or never bed-sharers. In addition, there were differences in educational background and ethnicity. A greater proportion of mothers who bed-shared frequently (62%) and intermittently (58%) had a university education compared to those who regularly returned their infant to a crib (50%). Few mothers in the study identified themselves as being of non-White ethnicity (9%), however non-White mothers comprised 12% of the group who bed-shared often, compared to 6% in those who rarely bed-shared.

The results of the significance tests comparing those who had provided near-complete bed-sharing data (combined across the Rare/Intermediate/Often subgroups) to those with insufficient bed-sharing data to characterise them (Poor response) are given in the PValue² column. When those mothers who had provided bed-sharing data were compared to those whose data were incomplete, the latter were younger, more likely to be non-white, and have lower household income.

[TABLE 3 HERE]

Discussion

Only 15/870 women with a prenatal intention to breastfeed reported that they never slept with their baby during the first 24 weeks of life. Women who bed-shared frequently were significantly more likely to continue breastfeeding to 6 months, than those who bed-shared intermittently or did not bed-share, supporting the results of a recent US study (18). However in the present study a significantly greater proportion of frequent bed-sharers also continued exclusive breastfeeding for longer, contrary to the US findings, though exclusive breastfeeding was not very common.

The women participating in this UK study were recruited during mid-pregnancy, and intended to breastfeed. The majority considered breastfeeding to be very or extremely important, and the vast majority were highly motivated to breastfeed their child. Those with a strong prenatal intention to breastfeed, previous breastfeeding experience, and higher educational achievement are known to continue breastfeeding for longer than other groups (17). We found that those who bed-shared more often were more committed to their breastfeeding intent, more likely to be university educated, and less likely to be White.

Given the relationship observed here between bed-sharing behaviour and prenatal intent to breastfeed, it seems likely that women who are motivated to achieve their breastfeeding goals incorporate bed-sharing into their night-time feeding strategy, a behavioural complex McKenna & Gettler (28) have recently termed ‘breast-sleeping’. Prior studies indicate that parents learn by experience that bed-sharing facilitates breastfeeding (25); one recent study found that mothers now create and share narratives that emphasise the importance of bed-sharing for coping with night-time breastfeeding (20).

A previous analysis of data from this study (17) we found that non-white ethnicity was associated with a significantly longer duration of breastfeeding, but not with exclusive breastfeeding. We have now shown a significant association between ethnicity and bed-sharing activity. The lack of consistency in association with both types of breastfeeding could be a consequence of the small sample of women in this study identifying as part of an ethnic minority, but given similar results in another recent UK study (29) it is more likely that this outcome reflects different cultural ideas regarding the introduction of complementary foods (30).

Given the complex relationship between bed-sharing and SIDS it is important that those parents most likely to bed-share understand the risk of SIDS given their own familial context. By engaging nulliparous women during pregnancy in conversations about the strength of their intentions to breastfeed, the importance they attach to breastfeeding, and their educational background, those most likely to incorporate bed-sharing into night-time infant care can be identified, which would enable risk minimisation information to be personalised to their circumstances. This is important as parents with no prior experience of night-time parenting need information about the risks associated with unintentional bed-sharing and how to minimise the potential risks that may arise with planned bed-sharing. This is a preferable strategy to attempting to eliminate bed-sharing in this group which a) is unlikely to be successful and b) may cause unintended harm by undermining breastfeeding duration.

There are limitations to this study. The problem of missing data limited the detail of the analysis that we hoped to achieve. Due to this missing data, younger mothers and mothers from lower income households were under-represented in the sample. Ethnic minorities also made up a small fraction of the sample due to the limited ethnic variability in the locality of the study; it would be valuable to repeat the study in a different area to evaluate the reproducibility of the results. The data set was generated as part of a study recruiting women with a prenatal intent to breastfeed, so these results cannot be generalised to women making alternate feeding choices for their child.

This study has unpicked some relevant details underlying the well-known association between breastfeeding and bed-sharing, demonstrating that women who are strongly motivated to breastfeed are those who most frequently bed-share. This suggests that commitment to breastfeeding engenders bed-sharing for many women, and an explanation for why women who bed-share breastfeed for longer than women who don't bed-share is that they begin with a stronger commitment to breastfeed. As the vast majority of participants in this study slept for some period with their babies this indicates that all breastfeeding mothers need information on doing so as safely as possible.

The results of this study do not support previous arguments that bed-sharing protects against early weaning. They do, however, raise the question of whether recommendations to avoid bed-sharing impede some women from the achievement of their breastfeeding goals, and thereby cause unintended harm to infant and maternal well-being, and even to lifetime health.

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Conflict of Interest Declaration

All authors declare they have no financial or other conflict of interest.

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Table 1: Sets of 6 four-weekly codes for mothers with similar bed sharing frequency across the duration of the trial

Bed share category	Example	Description
Rarely/did not bed share	000000, 010000, 000900, 000300	No more than one month with bed sharing.
Intermittently	011100, 011311, 330112, 933211,	No more than three moderate or frequent duration bed share intervals.
Often	333939, 333112, 330023, 333311	At least four moderate or frequent duration bed share intervals
Missing data	999999, 333999, 099901, 999903	At least three monthly intervals were coded as missing

Table 2: Characteristics of participants providing data for these analyses

Characteristic	Mean (SD)/n (%)	Sample size
Maternal age	31.43 (5.51)	870
Infant gestational age in weeks	40.10 (1.26)	870
Lives alone	95 (11%)	864
University-level Education	447 (54%)	828
Ethnic group = White	766 (91%)	842
Household income = below £20k	231 (28%)	827
£20-40k	265 (32%)	
above £40k	331 (40%)	
C-section delivery	217 (25%)	867
Multiparous, previously breastfed	409 (47%)	870
Multiparous, never breastfed	56 (6%)	
Primiparous	405 (47%)	
I will definitely breastfeed	472 (54%)	867
I think breastfeeding is* Extremely important	529 (61%)	867
Important	260 (30%)	
Not very important	70 (8%)	
Unimportant	8 (1%)	

* This categorical variable was created based on the original importance of breastfeeding variable which used a 5 point scale where 1 indicated not at all important and 5 extremely important. This re-categorised variable group 1 and 2 together as there were fewer than 10 mothers in these categories combined.

Table 3: Investigation of explanatory variables for duration of bed sharing in trial

Variables	Bed sharing category				Pvalue ¹	Pvalue ²
	Rare / Never (n=299)	Intermittent (n= 192)	Often (n= 187)	Poor response (n=192) ³		
Mean maternal age (SD)	31.38 (5.65)	32.16 (5.07)	31.52 (5.12)	30.68 (6.00)	0.27	0.03
Mean infant gestational age (weeks) (SD)	40.20 (1.32)	40.06 (1.16)	39.95 (1.30)	40.15 (1.22)	0.11	0.58
Lives alone %	12	8	9	12	0.40	0.42
University level Education %	50	58	62	50	0.03	0.17
Ethnic group = White %	94	93	88	85	0.04	0.005
Household income %						
< £20k	28	20	27	38	0.18	0.003
£20-40k	33	31	31	31		
> £40k	38	49	41	31		
C-section %	24	25	28	22	0.54	0.26
Previously breastfed					0.03	0.18
breastfed before %	40	48	52	51		
not breastfed %	8	5	4	8		
first baby %	52	47	44	41		
Would like to or will definitely breastfeed %	82	87	95	90	<0.01	0.37
Importance of breastfeeding (% response)					0.01	0.31
Extremely important	56	56	70	65		
Not extremely important	44	44	30	35		

¹ P-value from comparison of distributions of explanatory variables across the rarely/intermediate and often subgroups

² P-value from comparison of combined (Rarely/Intermediate/Often) to 'Poor response' subgroup

³ Women providing <3 months data with clear-cut bed sharing behaviour

For Peer Review Only


Figure 1: Illustration of scales on which women indicated breastfeeding intent and importance.

How important do you think breastfeeding is? Please circle your answer:

1	2	3	4	5
Not at all				Extremely
Important				Important

How likely do you think you are to breastfeed your baby? Please circle your answer

0	1	2	3	4	5
I definitely will not breastfeed	I probably will not but may try it	I have not decided about it yet	I will try and see what happens	I would like to breastfeed	I will definitely breastfeed



Women who circled this option (0) were not enrolled in the trial.

Figure 2a

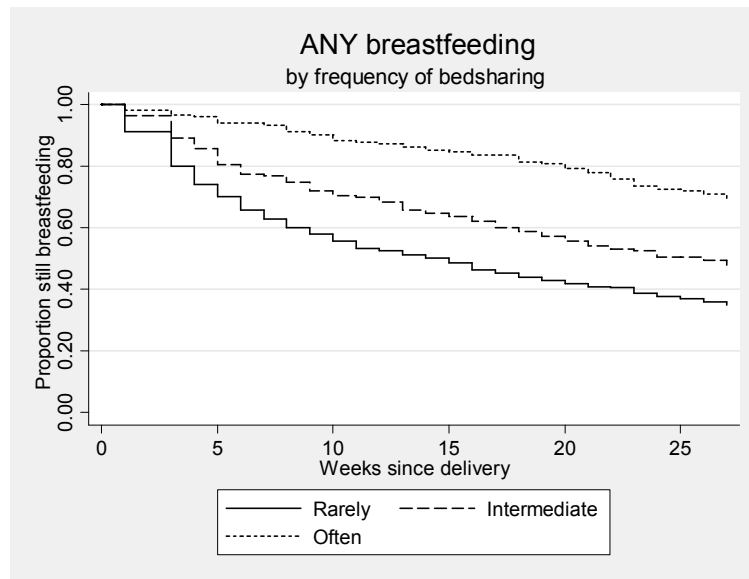


Figure 2b

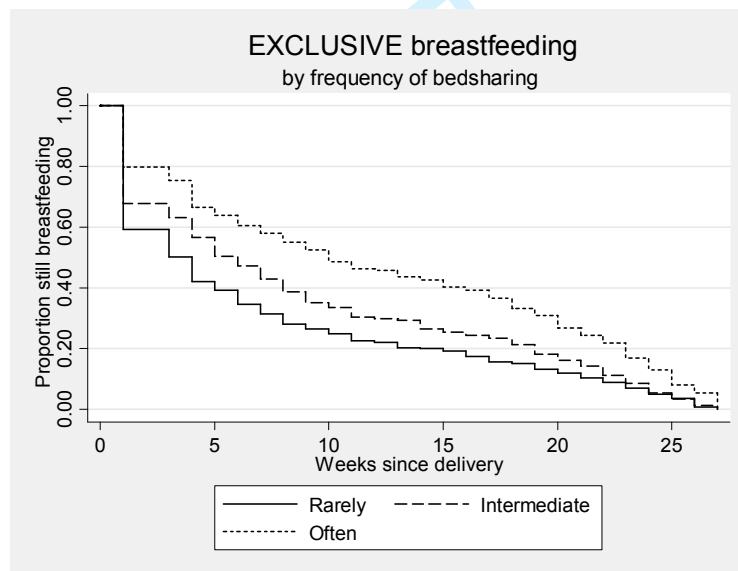


Figure 1: Illustration of scales on which women indicated breastfeeding intent and importance.

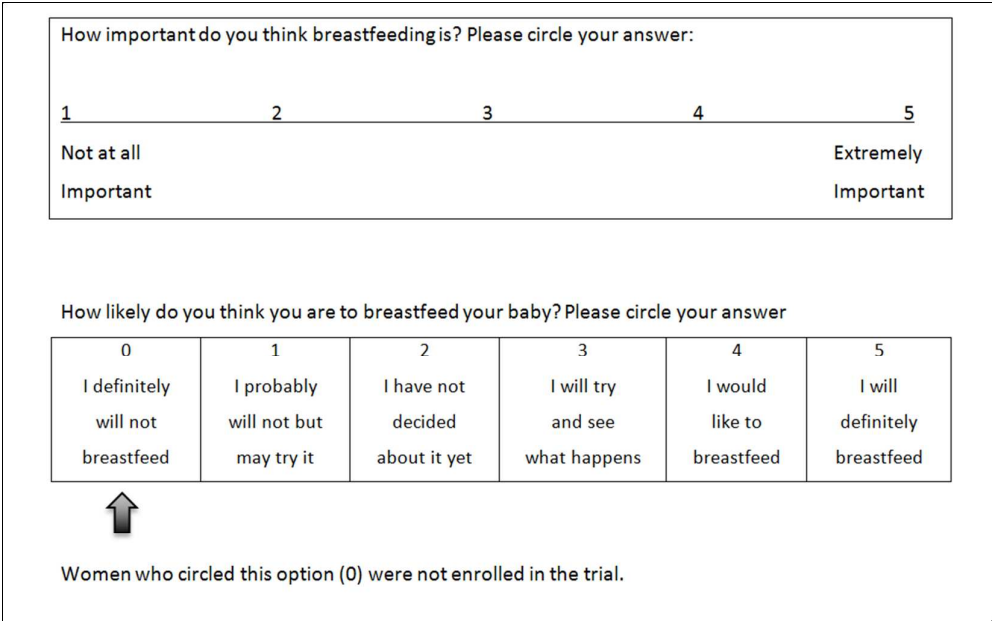


Figure 2a

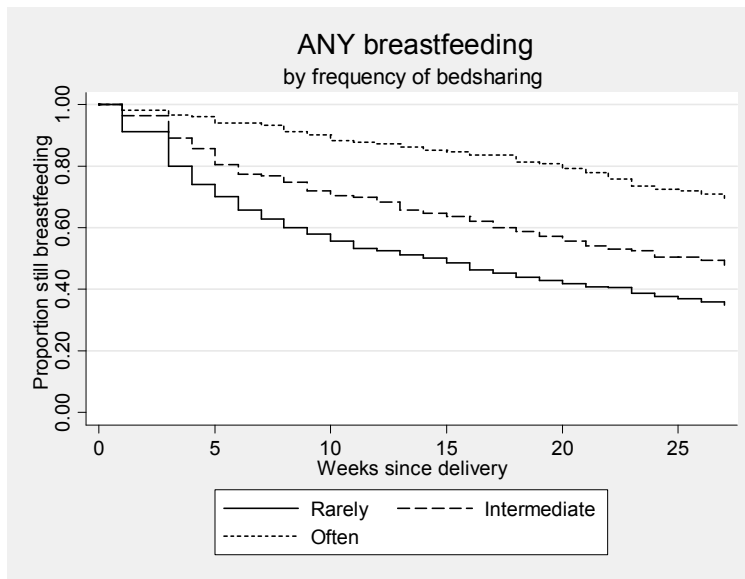


Figure 2b

